

**MEMORANDUM FOR** The Record

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**SUBJECT** NOAA-N HIRS (H305) Spectral Response Functions

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The Spectral Response Functions (SRFs) of the 19 infrared channels of HIRS for NOAA-N have been generated based on the optical piece part spectral response of this instrument. Attached are the SRFs in ASCII format (NNH305srf.txt), and plots in .pdf format (NNH305srf.pdf). Also attached is a graphic comparison of the H305 SRFs with those of NOAA-15, -16, -17 (H305srfcompare.pdf). The center wavenumbers, band correction coefficients, and temperature range sensed for NOAA-N HIRS (H305) are as follows:

Table 1. NOAA-N/HIRS/H305 Center Wave Numbers and Band Correction Coefficients

channel	center half power wavenumber bandwidth		band correction coefficients		T <sub>min</sub> (K)	T <sub>max</sub> (K)
	(cm <sup>-1</sup> )	(cm <sup>-1</sup> )	b	c		
1	668.18	3.81	0.001128	0.99999	210	280
2	680.94	10.45	0.008162	0.99996	200	265
3	689.68	14.68	0.019228	0.99991	195	240
4	703.81	15.91	0.017887	0.99992	190	250
5	714.34	16.86	0.019409	0.99991	185	265
6	731.54	17.00	0.019968	0.99991	180	280
7	750.56	19.26	0.109210	0.99973	180	290
8	900.46	34.88	0.065734	0.99977	180	330
9	1029.10	22.07	0.043472	0.99986	190	270
10	800.73	14.83	0.016207	0.99994	180	290
11	1364.70	39.12	0.071179	0.99982	180	290
12	1532.20	53.44	0.110780	0.99975	180	260
13	2189.20	20.69	0.017224	0.99997	180	300
14	2208.40	22.05	0.018594	0.99997	180	290
15	2238.40	21.65	0.019559	0.99997	180	280
16	2246.70	21.44	0.017640	0.99997	185	260
17	2419.20	27.78	0.029872	0.99995	190	280
18	2515.40	32.42	0.048696	0.99993	195	340
19	2666.10	101.30	0.280120	0.99962	220	340

Note: 1) T<sub>min</sub> and T<sub>max</sub> are the minimum and maximum temperatures used in generating the band correction coefficients.

2) HIRS level 1b data users can use the following procedure to convert the Earth scene radiance R into brightness temperature T (Weinreb, et al, 1981, NOAA Technical Report NESS 85):

$$T^* = \frac{c_2 v}{\ln(c_1 v^3 / R + 1)}$$

$$T = (T^* - b)/c$$

Where

R = scene radiance (mW/[m<sup>2</sup> sr cm<sup>-1</sup>])

T\* = effective temperature

c<sub>1</sub> = 1.1910427E-5 mW/(m<sup>2</sup> sr cm<sup>-4</sup>)

c<sub>2</sub> = 1.4387752 (K cm)

v = center wavenumber (cm<sup>-1</sup>)

T = scene brightness temperature

NNH305srf.txt is an ASCII file with a format identical to those for the previous instruments, i.e.,

```
Ch1      # of data points
Wavenumber  filter transmittance      sys. w/o filter      total sys      normalized total sys.
....

Ch2      # of data points
....
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The H305 SRFs are generated with the software used for generating the SRFs for the previous HIRS instruments. However, minor modifications were necessary to port the software from the IBM mainframe system to a PC-based Linux system, and to accommodate the significant increase in the number of data points for the filter transmittance (more than 1000 points for some channels, compared to the less than 200 points for previous instruments). We validated the ported software by reproducing the results for the NOAA-17 HIRS (H303).

With the exception of channel 7, the filter transmittance was provided by the parts suppliers at a much finer sampling than for the previous instruments. For most channels, the filter transmittance spectral sampling interval is 0.1 cm<sup>-1</sup>, but this interval is 0.05 cm<sup>-1</sup> for channels 2 and 3, 0.2 cm<sup>-1</sup> for channel 19, and with coarser, irregular intervals for channel 7. A Fast Fourier Transform (FFT) and running averages were used to filter out the high frequency noise in the tails of the SRF, which were most apparent in channel 2.

For additional information about the NOAA-N HIRS (H305) spectral response functions, please contact us at: [changyong.cao@noaa.gov](mailto:changyong.cao@noaa.gov), or phone 301 763-8136 x196.